Oct. 13, 1970 C. D. MILLER ET AL 3,533,624

MOVING TARGET DEVICES

Filed Aug. 25, 1967 3 Sheets-Sheet 1

FIG. 1

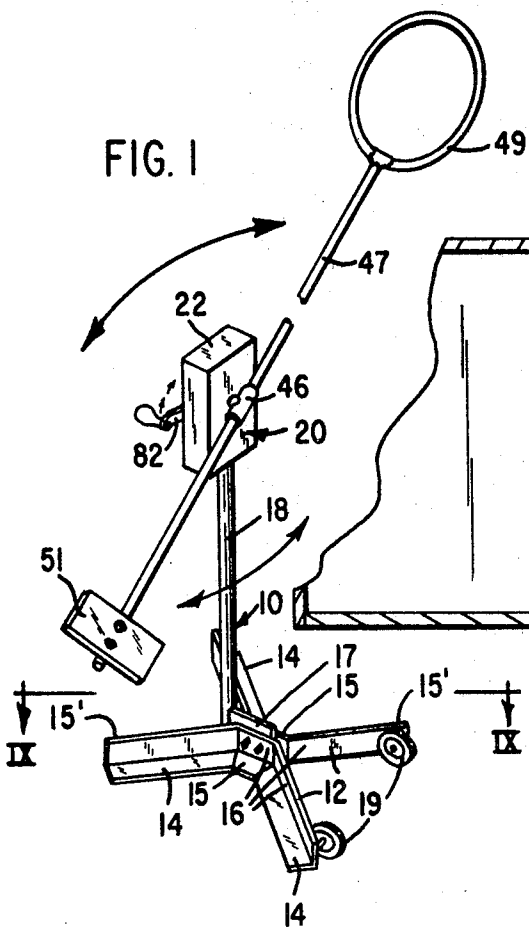


FIG. 4

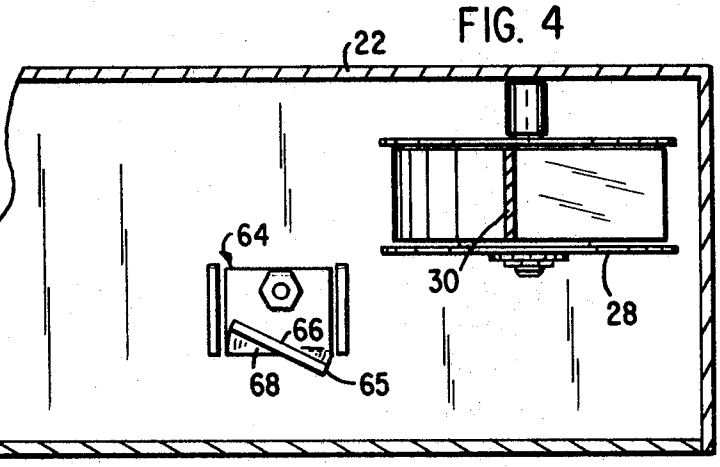
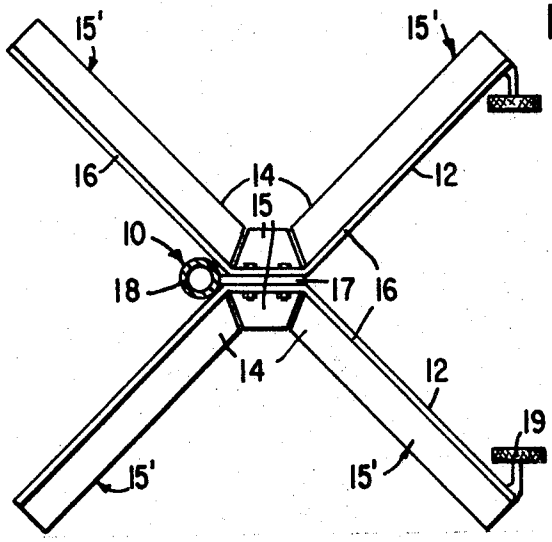


FIG. 9



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MOVING TARGET DEVICES

Filed Aug. 25, 1967 3 Sheets-Sheet 2

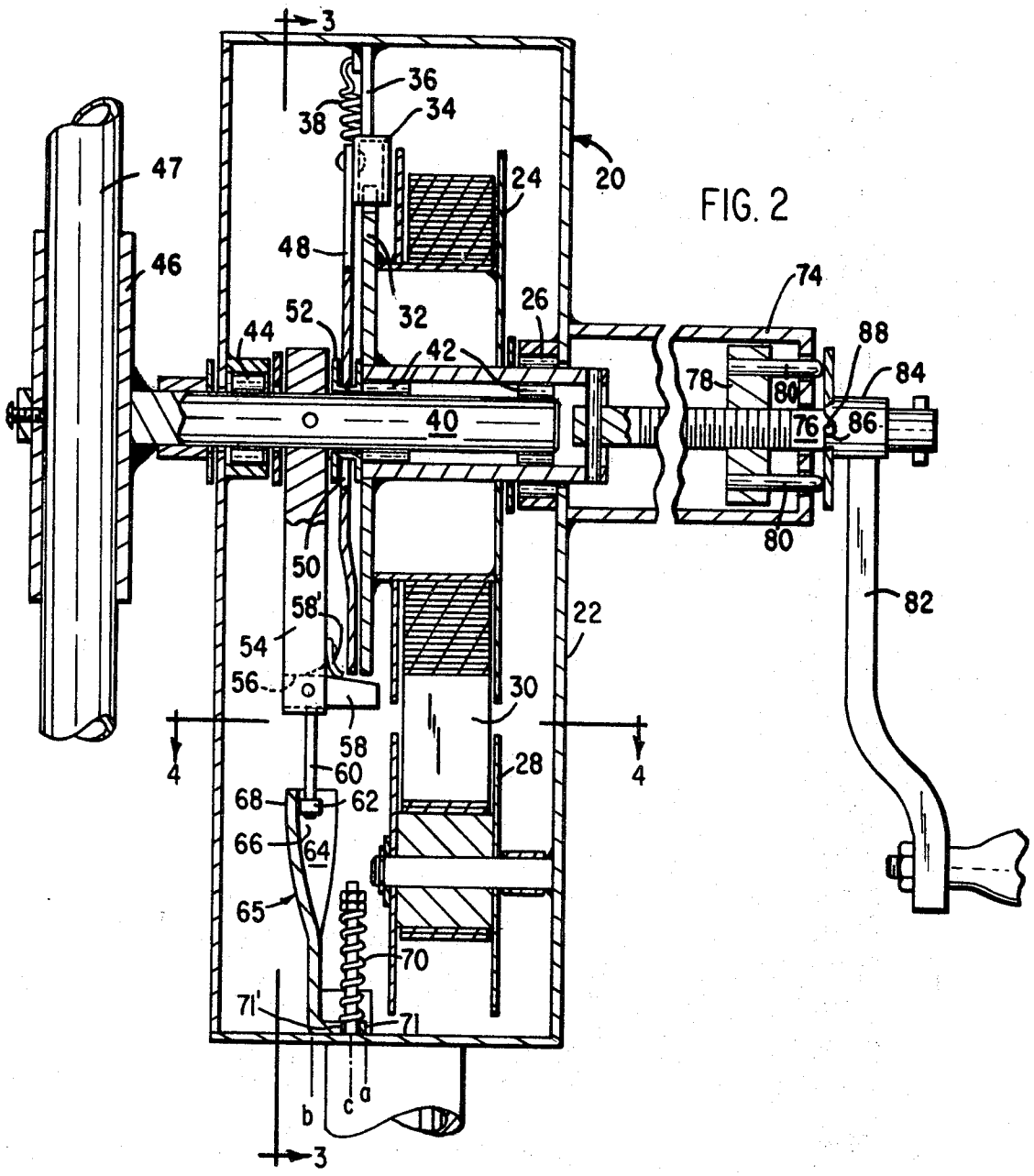


FIG. 2

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Filed Aug. 25, 1967 3 Sheets-Sheet 3

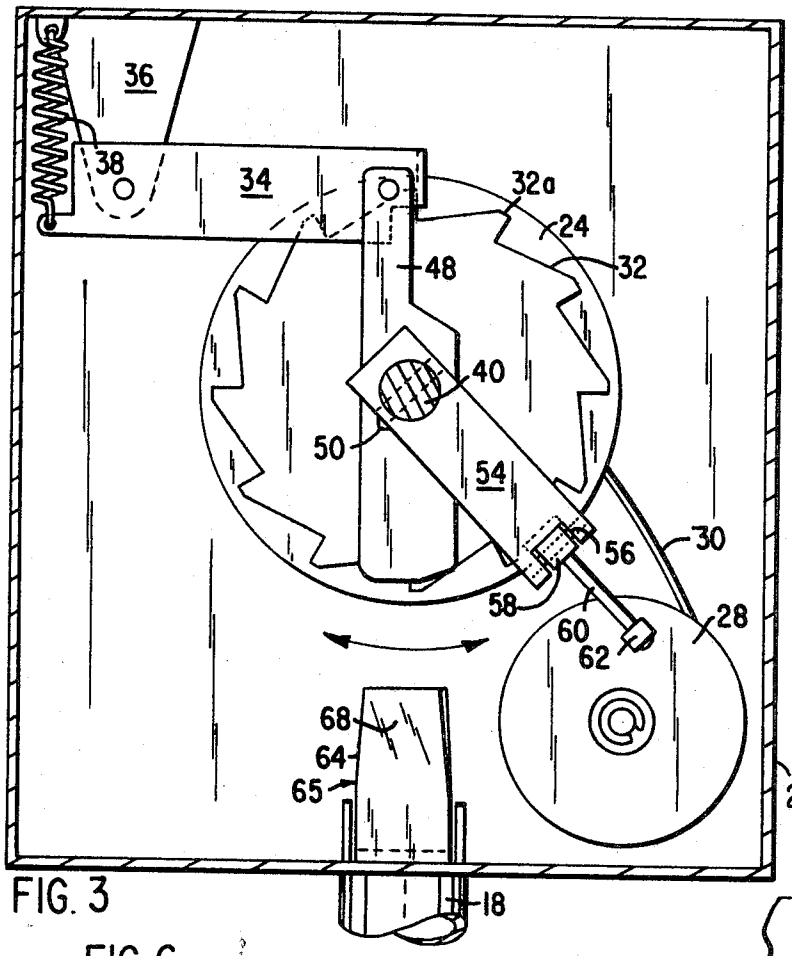


FIG. 3

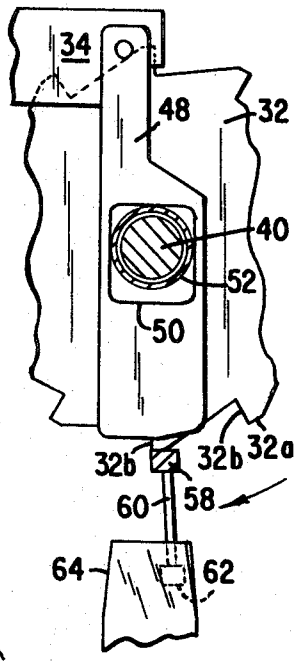


FIG. 5

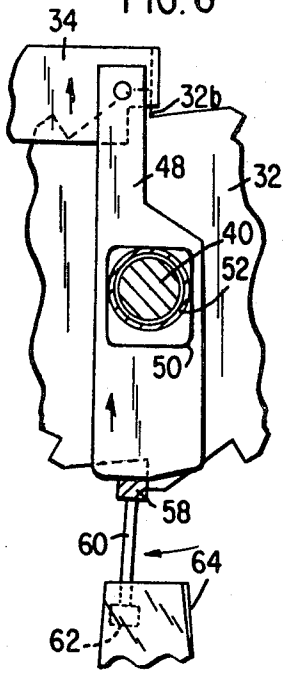


FIG. 6

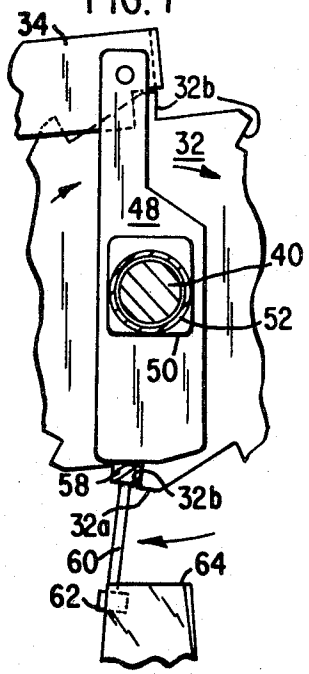


FIG. 7

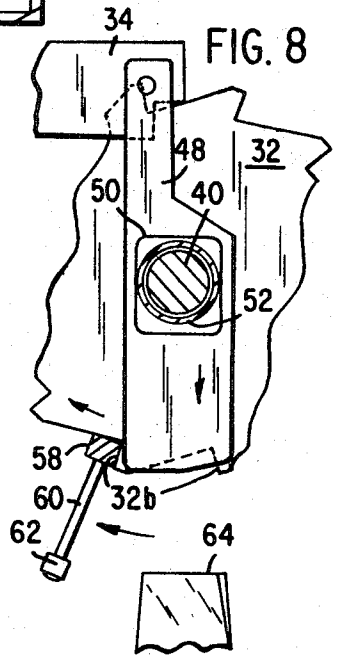


FIG. 8

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3,533,624

MOVING TARGET DEVICES

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Int. Cl. F41j 9/00
U.S. Cl. 273—105.2 9 Claims

ABSTRACT OF THE DISCLOSURE

A moving target adapted to oscillate under the influence of a spring motor, there being provided pawl and ratchet release mechanism operable, as the target moves through a selected position of its stroke, to release an increment of the energy stored in the spring motor and apply it to the target to provide its movement through its next succeeding stroke.

BACKGROUND OF THE INVENTION

In order to improve accuracy, it has been suggested those individuals participating in football contests who are charged with throwing the football practice throwing the football at a moving target. Devices for this purpose have been proposed whereby a hoop or a circular structural member be provided at the end of an elongated rod and that movement be provided to the rod to cause the circular portion to move to and fro. Such a device may be utilized to improve the accuracy of a thrown missile be it a football, baseball, or other device by offering a moving target to one hurling or throwing the missile.

In utilizing moving target devices of the kind described, particularly as far as a football is concerned, it is desirable that the device be constructed so that it can be employed in a field or other expansive practice area and that it be provided with means for insuring its oscillatory movement over a considerable length of time. While it will be understood that devices of the kind under consideration may be readily supplied with electrical motors, the inconvenience of providing electrical leads offers a serious disadvantage. Self-contained electrical power sources such as batteries require maintenance which adds to the operating expense.

Accordingly, it is the chief object of this invention to provide a moving target device of the kind described in which there is provided an improved self-contained power supply means for imparting continuous movement to the device over a substantial period of time.

It is a further object of the invention to provide a spring motor with unique means for releasing the energy stored by the spring motor to control the movement of the target device.

The objects and features of the invention will be apparent upon consideration of the ensuing specification.

SUMMARY OF THE INVENTION

This invention contemplates a moving target device wherein there is provided an elongated rod having a circular portion disposed at its extremity. In order that the rod be caused to oscillate in a predetermined path so as to offer a moving target, there is provided a power supply means in the form of a spring motor together with improved mechanism operable under the influence of the movement of the rod to release the energy stored in the spring motor and supply it to the rod for the purpose of providing movement to the rod.

The energy release mechanism includes a lifter arm for normally latching a pawl in a pawl and ratchet combination connected to the drive spool of the spring motor in position such that the ratchet and spring motor associated therewith are locked in a stationary position. A pin depends from a pick-up arm and rotates with the target supporting rod. The pin in turn is associated with a pivotally mounted finger carried by the pick-up arm and is arranged therewith so that the engagement of the swinging pin with a spring mounted cam member will cause the finger to force the lifter arm free of its pawl latching position and release the ratchet to permit the spring motor to rotate and deliver an increment of its stored energy.

This release of energy causes a tooth on the ratchet wheel to forcibly strike the finger, imparting rotation to the rod and disengaging the finger from the lifter arm, re-establishing latching engagement between the pawl and ratchet.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a perspective view of a preferred embodiment of the invention;

FIG. 2 is a cross-section, taken in elevation, of the power supply including the casing, employed with the device illustrated in FIG. 1;

FIG. 3 is a view taken along lines III—III on FIG. 2 showing certain of the operating parts of the energy release system utilized with the power supply;

FIG. 4 is an enlarged top plan view of the cam track taken along lines IV—IV on FIG. 2;

FIGS. 5, 6, 7 and 8 are partial fragmentary views of certain of the parts shown in FIG. 2, illustrating the position of certain of the parts in sequence during a portion of a cycle of movement of the target; and

FIG. 9 is a plan view partly in cross-section taken along lines IX—IX on FIG. 1 showing the supporting frame for the target device.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring more particularly to the drawings, there is shown a moving target device that may be used to improve the accuracy of a person desiring to acquire proficiency in the art of throwing a football. The device functions to cause a target to oscillate through an arcuate path. The person desiring to improve his accuracy places himself at a predetermined distance from the device and hurls a football or other missile at the target with the object being to hurl it through the hoop portion of the target device as the hoop moves through its path of travel.

A cycle of hoop travel is considered to be movement of the hoop from either of its extreme positions to the other and back to the original extreme position, a half cycle of travel being the distance the hoop portion travels in moving from a first extreme position to its other extreme position.

To this end, there is provided a main support frame **10** for the device. The support consists of structural steel angle members **12** having horizontal flanges **14** and vertical flanges **16**. The members **12** are formed in the manner shown in FIG. 1 so that a central section **15** and projecting end portions **15'** are formed. Interposed between the vertical flanges **16** of the central sections **15** is a plate **17**. The plate is secured to the central sections by conventional fastening means. Welded to one edge of the plate **17** is a main support pipe **18**. Completing the support assembly are wheels **19** attached to the projecting end portions **15'** through mounting brackets or the like. The wheels **19** are positioned so as to normally clear the floor or ground. They rotatably support the target when the unit is tilted forward. Thus the device may be easily moved from one position to another in a practice area.

One of the important features of the invention involves the provision of a power supply unit generally referred to at **20**. Briefly, the power supply unit involves a spring motor together with means for winding the spring motor and a mechanism for releasing the stored energy rep-

resented by the wound spring motor in such a manner that continued movement of the target device over a substantial period of time is assured.

A power supply unit is illustrated in FIG. 2 and includes a casing **22** supported on main support pipe **18**. The casing includes the usual side and end walls together with a top and bottom wall all formed of conventional structural material such as sheet steel stamped and formed to the desired configuration. Mounted within the casing **22** is a power spool **24** in a bearing **26** secured about an opening in one of the side walls. Mounted on the same wall is an idler spool **28**. Extending between the idler and power spools is a spring member **30** consisting of a flat band of steel wrapped upon itself, such a construction being commonly known as a negator spring. In its unstressed condition, the spring **30** is normally disposed about the idler spool with an end thereof connected to the power spool. Mounted on the power spool **24** coaxially therewith is a ratchet wheel **32**. Cooperatively associated with the ratchet wheel **32** is a pawl **34** pivotally mounted to a bracket **36** secured to the casing. Spring member **38** is provided for the purpose of urging pawl **34** into engagement with one of the teeth formed about the periphery of the ratchet wheel. A handle assembly to be later described is provided for the purpose of rotating the power spool in a manner such that the spring **30** will be wound about the power spool **24** while being unwound from the idler spool **28**. The winding of the spring about the power spool places the spring under tension. The tendency of the spring to return to its unstressed condition about the idler spool is resisted by the pawl and ratchet in the usual manner.

Power spool **24** is provided with a hollow central section in which are mounted bearings **42**. Supported in bearings **42** is a main power shaft **40**. A roller bearing **44** is secured to the inner surface of a wall of the casing and also supports main power shaft **40** in a manner such that an end thereof projects beyond the casing and mounts a sleeve **46**. Adjustably arranged within sleeve **46** is an elongated rod **47** having a circular end or hoop section **49** forming the target through which it is desired to hurl the missile. A counterweight **51** is adjustably attached to the other end of the rod.

Another important feature of the invention is the provision of mechanism for releasing the energy stored by the spring after it is wound on the power spool. To this end, there is provided a lifter bar **48** having an enlarged central aperture **50** disposed about a mounting sleeve **52** located within the casing. The enlarged central aperture **50** permits lifter arm to move vertically relative to the power shaft **40** and the sleeve **52** encircling it. The upper end of the lifter bar **48** is connected to the pawl, while the free lower end of the lifter bar is arranged adjacent the ratchet wheel as shown in FIGS. 2 and 3. Lifter bar **48** together with ratchet wheel **32**, pawl **34**, bracket **36** and spring **38**, may be considered as means for maintaining the spring in position on the spool.

A pick-up arm **54**, FIGS. 2 and 3, is pinned to the main power shaft **40** so as to rotate therewith. It will be apparent that with the elongated rod **47** assembled within the sleeve **46** the path described by pick-up arm **54** is parallel to that generated by the elongated arm **47**. Located at the lower end of the pick-up arm **54** is a notch **56** extending from the lower edge upwardly. Pivotally mounted within the area defined by the notch is a finger **58**. The notch and finger are shaped so that the finger may swing upwardly or counterclockwise as viewed in FIG. 2 relative to the arm but is restrained from clockwise rotation except as may be provided by the action of a leaf spring **58'** urging it to return to its "at rest" position shown in FIG. 2 after such limited upward or counterclockwise movement as will be hereinafter described. The normal position of the finger **58** is shown in FIG. 2. Departure of the finger from this normal position so as to swing upwardly or counterclockwise as hereinafter

described will initiate the action resulting in the transfer of energy from the spring motor to the target support rod **47**. Depending from the finger **58** is a pin **60** equipped with a cam roller **62** at its lower extremity The arm **54**, finger **58** and pin **60** may be considered as a pivoted lever mechanism.

Disposed below the cam roller **62** is a cam track assembly **64**. The cam track assembly **64** includes an upstanding cam member **65** having opposed surfaces **66** and **68**. Cam member **65** is provided with a flange portion **71** having an opening **71'** through which extends rod and spring assembly **70**. Referring to FIG. 2 the cam member is constructed so as to pivot against the action of the spring assembly in either a clockwise or a counterclockwise direction. When pivoting in a clockwise direction, the fulcrum is located at point *a*. When pivoting in a counterclockwise direction, the fulcrum is located at point *b*. The spring **70** exerts a downward force through point *c*. By varying the distance between *a* and *c* on one hand and between *b* and *c* on the other, it will be evident that the cam member will have more resistance to pivoting in one direction than in the other. In the construction illustrated, the cam member **65** will have more resistance to rotation in a counterclockwise direction than in a clockwise direction.

As pointed out above, the power spool is rotated for the purpose of winding spring **30** thereabout. A particular feature of the invention involves a handle assembly which prevents over-winding of the power spool and at the same time prevents, once the spring is released so as to return to its position of normal repose on the idler spool, complete separation of the spring from the power spool. The handle assembly includes a housing **74** arranged about the casing opening mounting the power spool. Connected to the power spool and disposed within the housing **74** is a threaded shaft **76** having a follower **78** of a configuration, as compared to the configuration of the housing, so that it will travel axially along the threaded shaft in response to rotation thereof. In other words, follower **78** travels in a lead screw type movement as the shaft is rotated. Follower **78** is provided with pins **80** projecting therefrom. Assembled about the end of threaded shaft **76** is crank **82** including a collar or hub **84** having a notch **86** disposed therein. A shaft pin **88** is arranged to be received within the notch **86**. Shaft pin **88** is affixed to the shaft **76**.

Considering the operation of the invention, the parts are so arranged that upon rotation of crank **82** with pin **88** engaged in notch **86** power spool **24** will rotate in the same direction and cause the spring **30** to be wound thereabout from idler spool **28**. The ratchet wheel **32** being secured to the power spool prevents the spring from rotating the power spool in a reverse direction. After a predetermined number of turns, follower member **78** travels to a position within the housing such that pins **80** project therefrom through openings provided in the housing wall and cause the collar **84** to slide out of engagement with the pin **88** so that continued rotation of the crank will not cause a corresponding rotation of the threaded shaft and power spool but will rather turn freely relative to the threaded shaft **76**. At this point, the spring **30** has been substantially transferred from the idler spool **28** to the power spool **24** leaving of course an end portion secured to the idler spool.

With the elongated rod **47** assembled within sleeve **46** and secured by a set screw or the like and the counterweight **51** applied to the rod, the parts are in proper position for initiating continuous operation or oscillatory movement within the limits determined by spring **30**. The elongated rod is then rotated to a position coincident with an extreme position of its desired arcuate path. The rod is then released and rotates under the influence of the counterweight toward a position representing the other extreme end of its arcuate travel. As the rod rotates, arm **54** rotates with it and finger **58** is in the position

shown in FIG. 2 with about 1/16 inch clearance with the ratchet wheel. Eventually, the cam roller **62** carried by pin **60** will engage cam surface **66** on cam member **65** urging finger **58** to swing upwardly or counterclockwise as viewed in FIG. 2. Upward rotation beyond the clearance between the finger and ratchet wheel at this particular point, however is resisted by engagement between the finger **58** and the relatively flat surface **32***a* on a tooth of the ratchet wheel, note FIG. 5. Continued rotation of the arm **54** and the shaft **40** causes finger **58** to ride along the flat surface **32***a* resulting in compression of spring **70** as the cam member attempts to rotate counterclockwise under the force exerted thereagainst by the roller **62**. Eventually, as rotation of the rod and arm **54** continues, finger **58** travels beyond tooth surface **32***a* at which time resistance to the previously loaded spring **70** is removed and the finger **58** abruptly continues its interrupted upward or counterclockwise movement under the impetus of spring **70** so that the parts assume the positions shown in FIG. 6 and FIG. 7. At this stage, lifter bar **48** is moved abruptly upward disengaging the pawl **34** from the ratchet wheel **32**, note FIG. 7. The ratchet wheel now rotates under the influence of the energy in the spring **30** and carries finger **58** to the left by engagement of the surface **32***b* on the previous tooth, enabling lifter arm to again drop under the influence of spring **38** and effect engagement of the pawl **34** with the next circumferential tooth on the ratchet wheel terminating movement of the ratchet wheel. At the instant the ratchet wheel rotation terminates, spring **58'** causes finger **58** to drop to the position shown in FIG. 2.

The forcible contact of the surface **32***b* against finger **58** imparts swinging movement to the power shaft **40**, sleeve **46** and rod **47** against the action of the counterweight. As the rod reaches the end of its arc of movement under this force or a half cycle as defined above, the counterweight causes the parts to swing downwardly through the arcuate path traveled. The roller **62** now engages the surface **68** of the cam member **65**. As explained above, the cam member **65** is urged to pivot about point *a*, note FIG. 2. The strength of spring is such that the desired pivoting action may be accomplished without damaging the connection between finger **58** and arm **54** and at the same time offer a minimum of resistance to the movement of the arm. It will be appreciated that energy used to overcome spring **70** will diminish the momentum previously imparted to the arm. The momentum furnished by the counterweight carries the rod **47** to the other end of its arcuate path so as to complete a full cycle of travel. As the rod changes direction, still under the influence of previously described force and counterweight actions, it approaches the cam member **65** so as to engage surface **66** again and repeat the action above described.

The described power cycle will be repeated until the energy represented by spring **30** has been dissipated through the periodic movement of the ratchet wheel which in turn permits the spring to re-wind itself about idler spool **28**. The successive increments of rotational movement of the ratchet wheel cause corresponding movement of the shaft **40**. This latter movement in turn causes follower **78** to travel to the left as viewed in FIG. 2. Eventually, the follower **78** will engage the end of the spool **24** and thereafter act as a brake to prevent complete separation due to unwinding.

While we have described a preferred embodiment of the invention, it is to be understood the invention is not limited thereto since it may be otherwise embodied within the scope of the following claims.

We claim:

1. Moving target apparatus comprising support means, power supply mechanism sustained by the support means, an elongated rod having a target portion at one end thereof, said rod being connected to said power supply mechanism to receive movement imparted thereto for oscillating the rod through an arcuate path, said mechanism comprising:

a casing serving as a housing for the operating parts of the mechanism,

a power spool,

an idler spool spaced from said power spool,

spring means connecting the idler spool with the power spool, said spring means being normally wound about said idler spool when the spring is in its unstressed condition,

a main shaft supported in said casing, said rod being connected to said shaft,

a ratchet wheel associated with said power spool,

a pawl for engaging said ratchet wheel,

handle means for imparting rotation to said power spool to cause said spring to be wound onto said power spool from said idler spool and to be maintained about said power spool by said pawl and ratchet wheel engagement,

means operative in response to movement of the rod for momentarily disconnecting the pawl from the ratchet wheel and after a predetermined movement of the wheel under the influence of the energy released from the stressed spring, re-establishing engagement of the pawl and ratchet wheel, said means including

a bar connected to the pawl,

an arm secured to said main shaft,

finger means carried by said arm, said finger means having limited upward movement relative to the arm, and

cam means for imparting upward movement to said finger means as the finger means moves together with the arm and rod in one direction through its path of travel, thereby causing movement of the lifter bar and release of the pawl from the ratchet wheel, movement of the ratchet wheel in response to the pawl release driving the finger means out of engagement with the lifter bar to re-establish connection between the pawl and ratchet wheel while imparting movement to the finger means and the rod with which it is associated.

2. Moving target apparatus as described in claim **1** wherein said cam means includes a pivotally mounted abutment member having a first surface for engagement by the finger means when the rod is traveling in one direction in its arcuate path and a second surface for engagement by the finger means when the rod is traveling in its opposite direction, the resistance to the pivoting action when one surface is engaged by said finger means being greater than the resistance to the pivoting action when the other surface is engaged.

3. Moving target apparatus as described in claim **2** wherein said cam means includes a spring against which the pivoting action of the abutment member is accomplished, the spring and abutment member being arranged relative to the ratchet wheel so that during one direction of movement of the rod and finger means engagement of the finger means and the cam means compresses the spring.

4. Moving target apparatus as described in claim **1** wherein said handle means includes mechanism for automatically discontinuing the winding of the spring about the power spool.

5. Moving target apparatus as described in claim **1** wherein said handle means includes a shaft connected to the power spool, said shaft having a pin connected thereto, a collar about the shaft and slidable relative thereto, a crank connected to the collar, said collar having a pin receiving notch for engagement therewith to rotate the shaft and means for disengaging said collar from said shaft after a predetermined length of spring has been wound onto the power spool by rotation of the shaft.

6. Moving target apparatus as described in claim **5** wherein said last mentioned means includes a follower

adapted to travel longitudinally of the handle means shaft as it rotates, said follower engaging said collar and slidably disengaging it from the pin after a predetermined rotation of the handle means shaft.

7. Moving target apparatus comprising:

(a) support means;

(b) a target device including an elongated rod having a target portion at which missiles may be directed;

(c) power supply mechanism attached to the support means, said power supply mechanism including:

(i) a spring motor comprising a spool, a spring, means for winding the spring about the spool so that the spring is releasably secured under stress representing a force of predetermined magnitude;

(d) means for releasably maintaining the spring in a preselected position about the spool;

(e) means connected to the elongated rod for supporting the rod from the power supply mechanism;

(f) means associated with the rod supporting means for periodically engaging the means for maintaining the spring member in a preselected position to change the position and effect incremental release of energy from the stressed spring, said means including a pivoted lever mechanism effective only after a predetermined movement to engage a first portion of the spring position maintaining means to accomplish temporary release of the means maintaining the spring member in a preselected position and thereafter be in turn forcibly engaged by a second portion of the spring position maintaining means so as to be disengaged from the first portion whereby the force exerted by engagement between the second portion imparts movement to the elongated rod; and

(g) means effecting the desired pivotal movement of the lever mechanism as the rod moves in a predetermined direction through its path of movement.

8. Moving target apparatus as described in claim 7 wherein said last-mentioned means includes a pivotally mounted cam arranged so that when the rod moves in one direction, engagement with a first surface thereof by the pivoted lever mechanism will move same in the desired direction to actuate the spring position maintaining means, said cam being mounted so that upon engagement with a second surface by the pivoted lever mechanism, occurring as the rod moves in the opposite direction, pivotal movement of the cam as opposed to pivotal movement of the lever mechanism obtains.

9. Moving target apparatus as described in claim 8 wherein a spring biases said cam to a predetermined position, the parts being arranged so that upon initial engagement between the pivoted lever mechanism and the first surface of the cam, the cam moves in a direction to compress the spring, additional movement of the pivoted lever mechanism beyond the initial engagement accomplishing contact with the first portion of the spring position maintaining means with the energy represented by the compressed bias spring being transferred to the pivoted lever mechanism.

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58—48; 273—55